Planning a CBTC wayside infrastructure to improve brownfield deployment

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### General considerations for resignalling

#### Objectives
- Renew ageing equipment / manage obsolescence
- Improve safety standards
- Increase capacity, reliability, availability – Decrease journey time
- Improve operations
- Reduce maintenance costs
- Bring state-of-the-art features

#### The brownfield challenge
- No impact on revenue service
- Limited engineering hours for installation and testing
- Restore safe operation every morning
- Interface with legacy systems
- Limited room for installation
- Support change management for operators and maintainers

It is key to understand the specificities of a project to define the best strategy that fits a given authorities objectives
Integrated Team

- Early common understanding of customer needs and priorities
- Understand operating rules and constraints
  - Agree on future operating rules
    - Close involvement of operators, drivers, local and central train dispatchers
    - Participation throughout in the entire development process.
- Ensure efficient and consistent customer involvement in review process
- Open discussions and team work
  - Co-location of representatives of the authorities and suppliers
    - Facilitates ensuring operational concepts are well understood
    - Joint development of installation and test and commissioning activities
Brownfield Interfaces

- Multigeneration existing install base
  - Poor or incomplete detail
  - Lack of commitment on accuracy

- Authority ownership over existing signalling system documentation
  - Commit in advance contracts
  - Provide detailed interface definitions
  - Accurate and committed geographic track mapping
  - Asset positioning
Design for success

- Minimize bespoke requirements
  - built on past experiences: benefits from previous projects
  - safety and deployment process is already mastered
  - high level of proven in use for critical components

- Maximize the level of independence between the new CBTC system and the old signalling
  - Equip all vehicles with CBTC

- Limited modifications to the old system and operating procedures.

- Optimizing an efficient day/night switch
Prior to field deployment

- Use of a robust factory integration and validation platform

- Fully duplicate and simulate the delivered system in advance of deployment
  - Integrated test strategy with full functional, operation and safety validated in a fully safety-compliant process in a lab setting.
  - Test track testing for added confidence

- Eliminates bugs and troubleshooting prior to field delivery

- Mature software and data instantiation minimizes bugs; limits site testing and regression testing.
Site activities and access

- Ensure efficient site activities: installation, test and commissioning
  - Agreed and sufficient access to the track provided by the customer
  - Optimised onsite testing via pre validation in lab and on test track
    - Milano Line 1 commissioned with only 3 days of shutdown

- Have a reasonable schedule adapted to the complexity of the project

- Agree on the migration strategy
Renovation Case Study - Milano L1 (Italy)

- Full renovation with minimal interruption (3 days)
- Urbalis revamping of 27 km metro line with train fleet spanning new and 40 year old trains in 4 years
- Increased capacity by 40% and energy savings by up to 30%
- 600,000 passengers per day

Customer: Azienda Transporti Milanesi
Type: Renovation
Line length: 27 km tunnel
Nb of stations: 38 + 2 depots
Nb of trains: 32 trains – 130m
3 different fleets
Revenue service: January 2010 (mixed traffic)
2011 Full CBTC